US008894373B2

(12) **United States Patent**
Firic

(10) **Patent No.: US 8,894,373 B2**
(45) **Date of Patent: Nov. 25, 2014**

(54) **VERTICAL SPIRAL ANGLE WIND TURBINE**

(76) Inventor: **Paul Firic**, Welland (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 568 days.

(21) Appl. No.: **13/234,228**

(22) Filed: **Sep. 16, 2011**

(65) **Prior Publication Data**

US 2012/0082560 A1 Apr. 5, 2012

Related U.S. Application Data

(60) Provisional application No. 61/388,088, filed on Sep. 30, 2010.

(51) **Int. Cl.**
F03D 3/06 (2006.01)

(52) **U.S. Cl.**
CPC ***F03D 3/061*** (2013.01); ***F03D 3/065*** (2013.01); *F05B 2250/25* (2013.01); *Y02E 10/74* (2013.01)
USPC ..... **416/223 R**

(58) **Field of Classification Search**
USPC ..... 416/242, 243, 176, 223 R, 224, 117, 416/119, 120, 210 R, 204 R, 211; 415/4.2, 415/4.4, 907, 905; 290/55, 44
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,115,027 A * 9/1978 Thomas 415/53.1
7,494,315 B2 * 2/2009 Hart 415/4.2

* cited by examiner

Primary Examiner — Edward Look
Assistant Examiner — Maxine Adjagbe

(57) **ABSTRACT**

The present device is a vertically oriented wind turbine blade having a rectangular curvilinear shaped blade which includes a top edge, a bottom edge, an outer edge, a helical inner edge, an inner surface and an outer surface. The blade's top edge is curved and defines a radius R and the helical inner edge defines an angle theta relative to a vertical reference line. The blade further includes an L shaped outer rib with a transverse leg mounted to the inner surface and extending along the outer edge, the outer rib also includes a perpendicular leg extending perpendicular to the transverse leg.

10 Claims, 8 Drawing Sheets

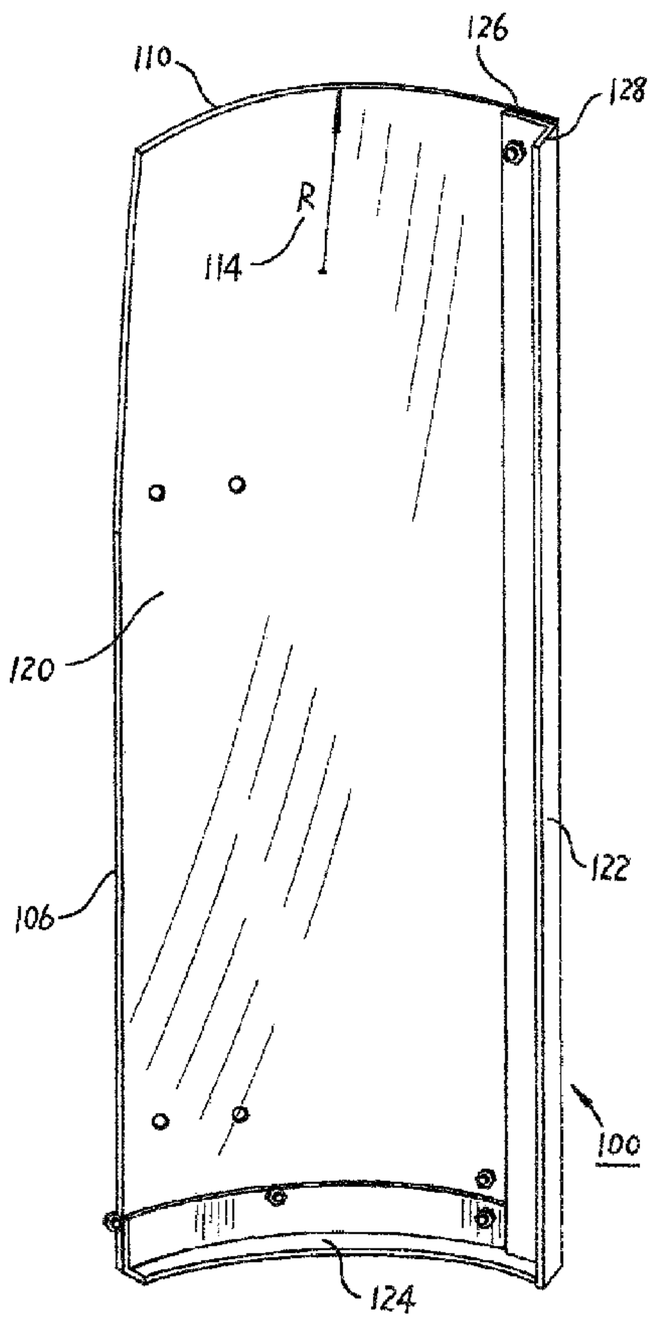


Fig. 1

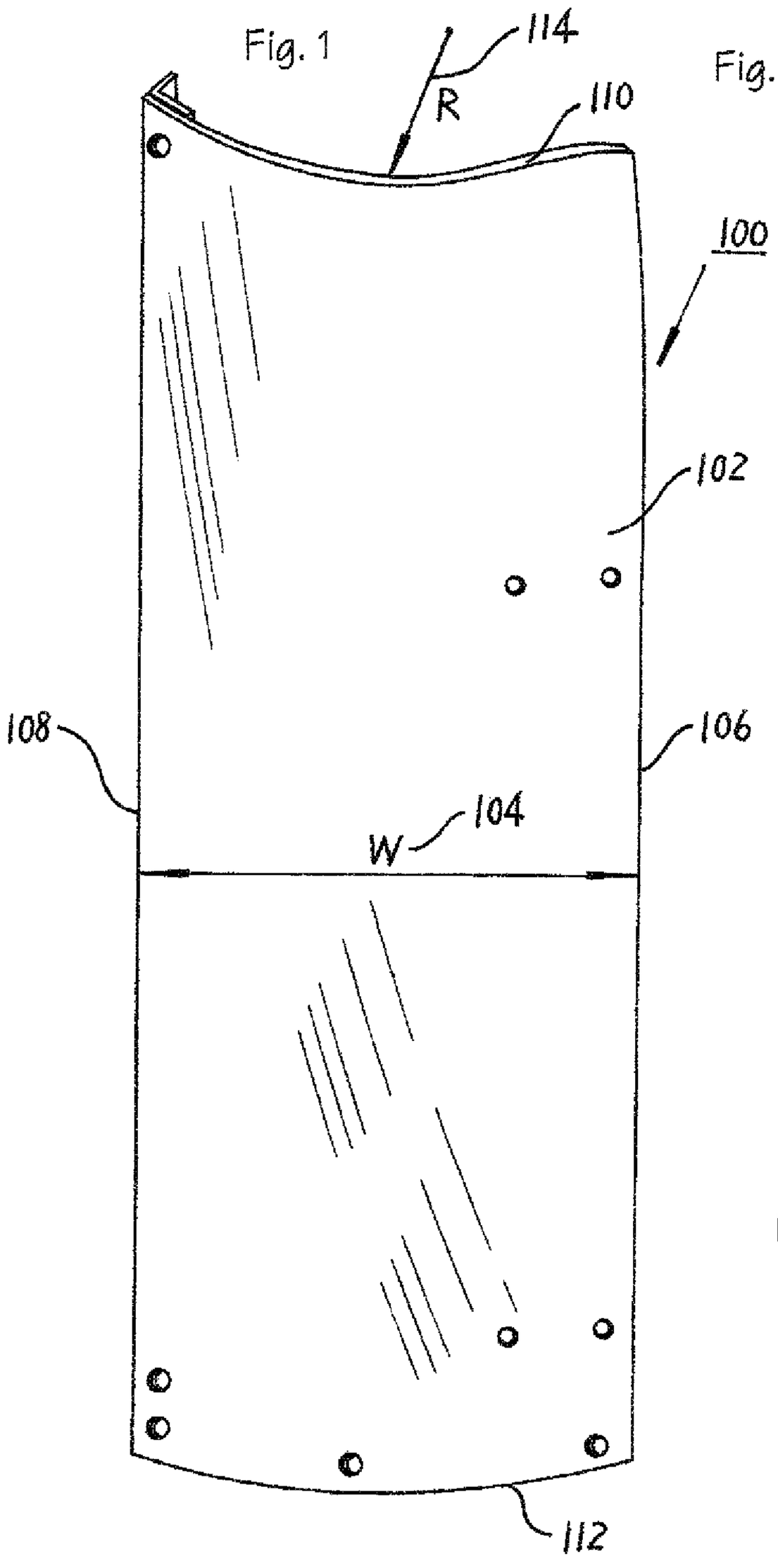


Fig. 2

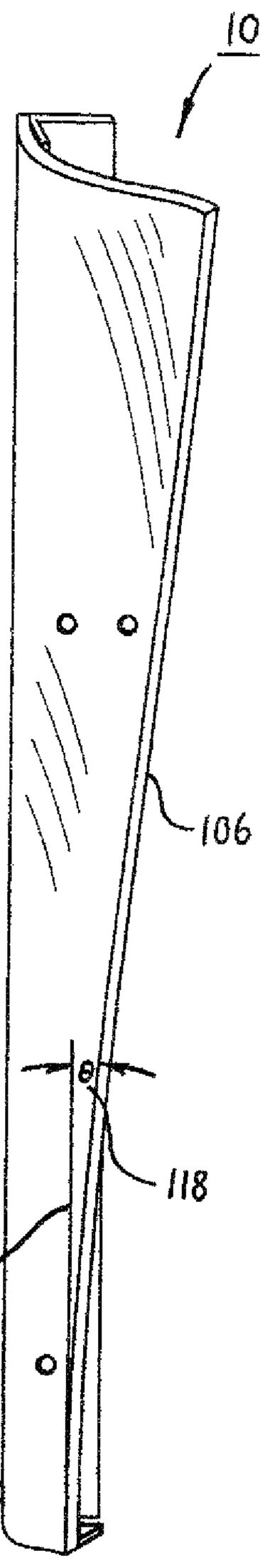


Fig. 3

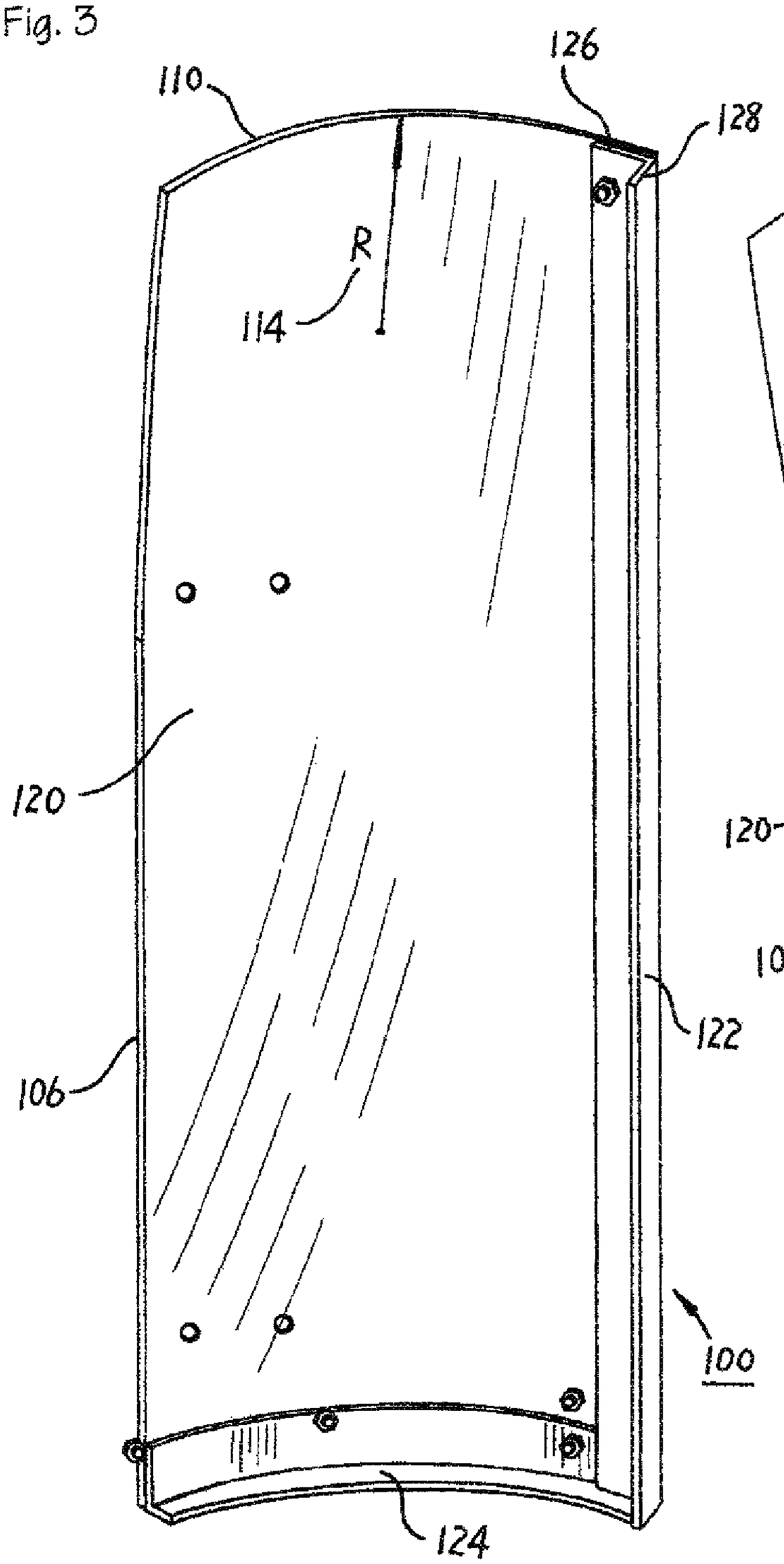


Fig. 4

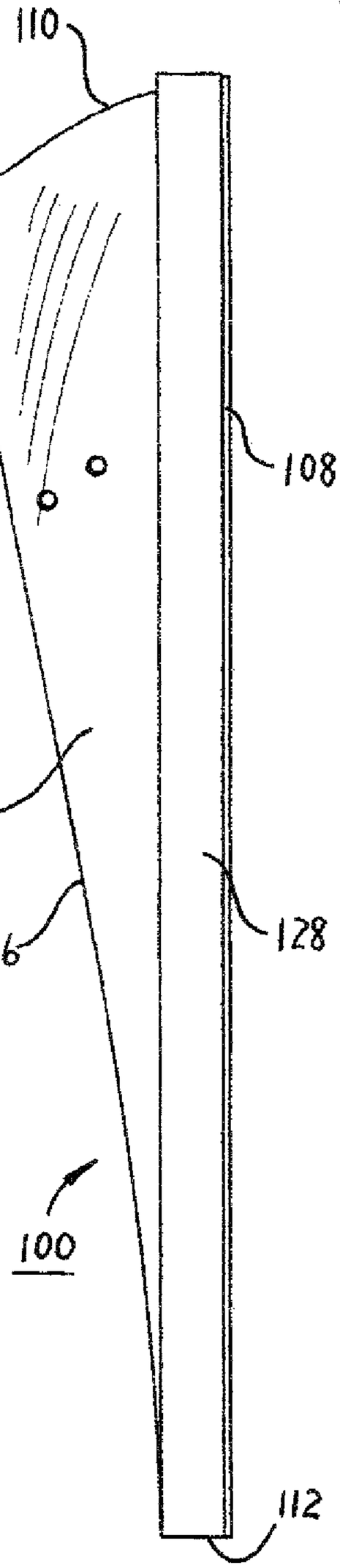


Fig. 5

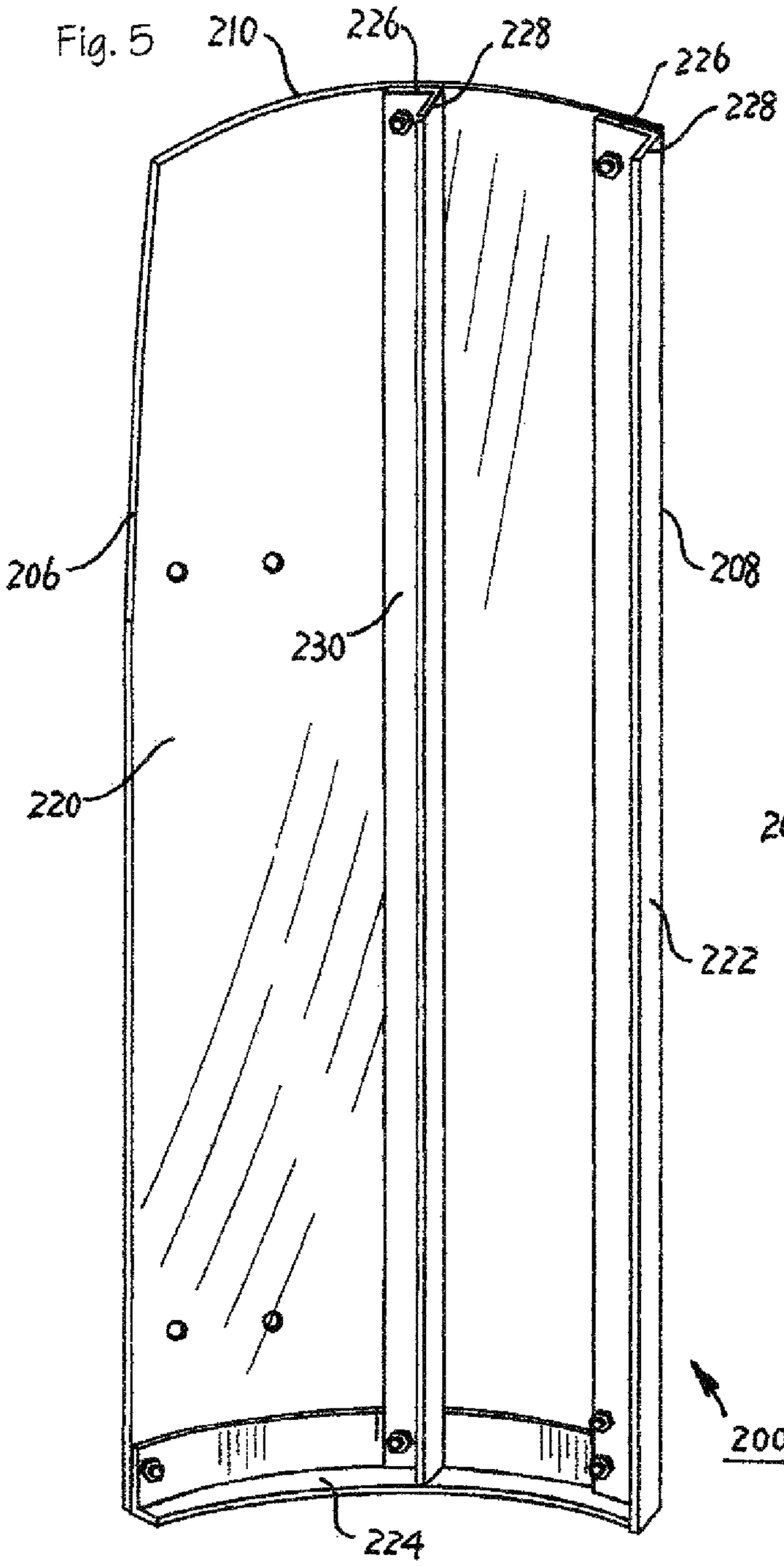


Fig. 6

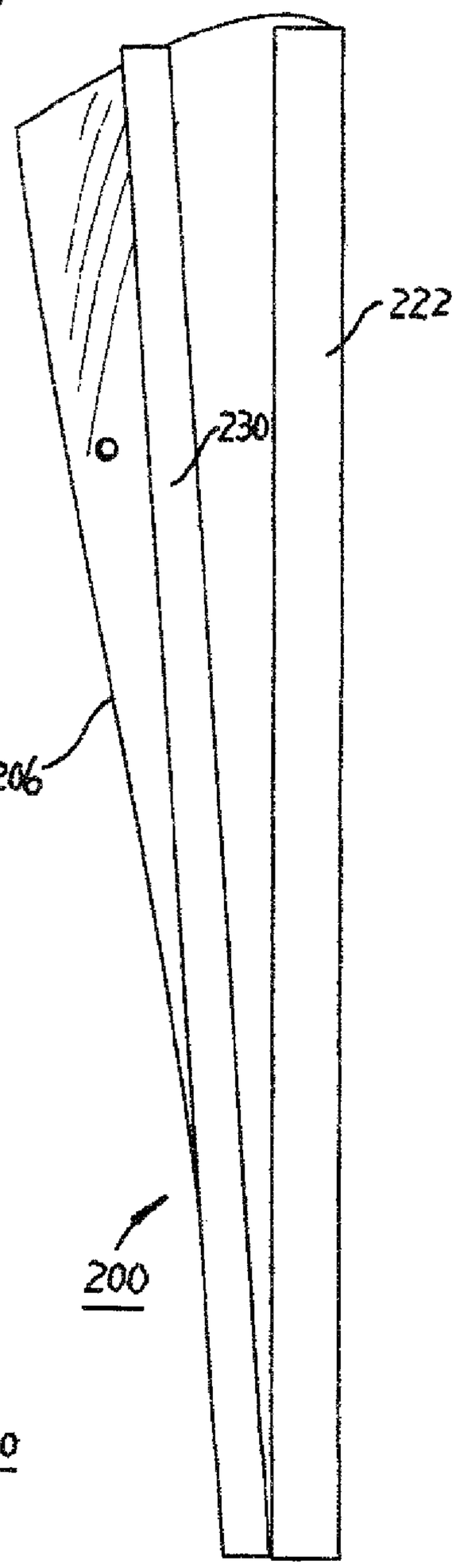
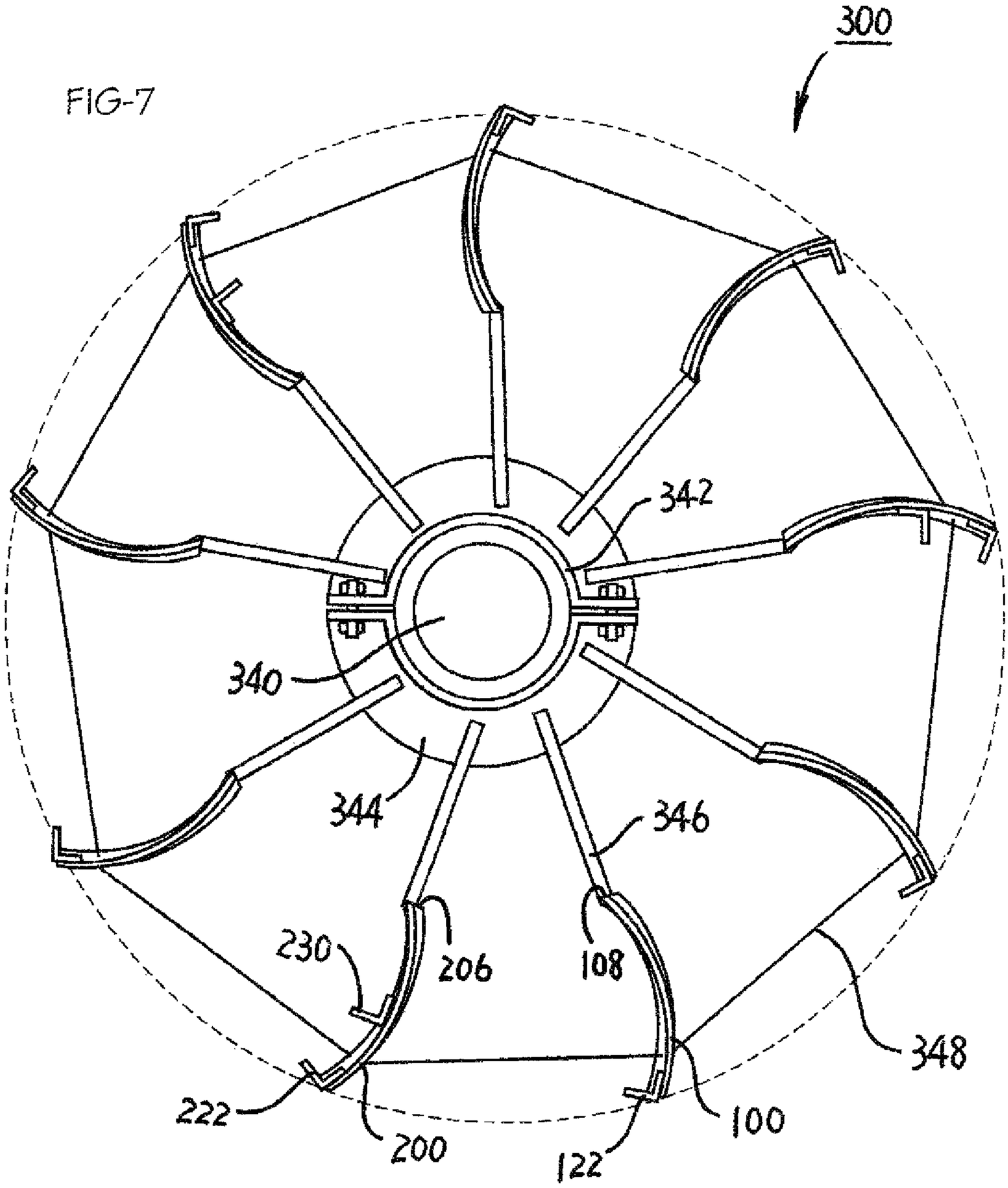


FIG-7



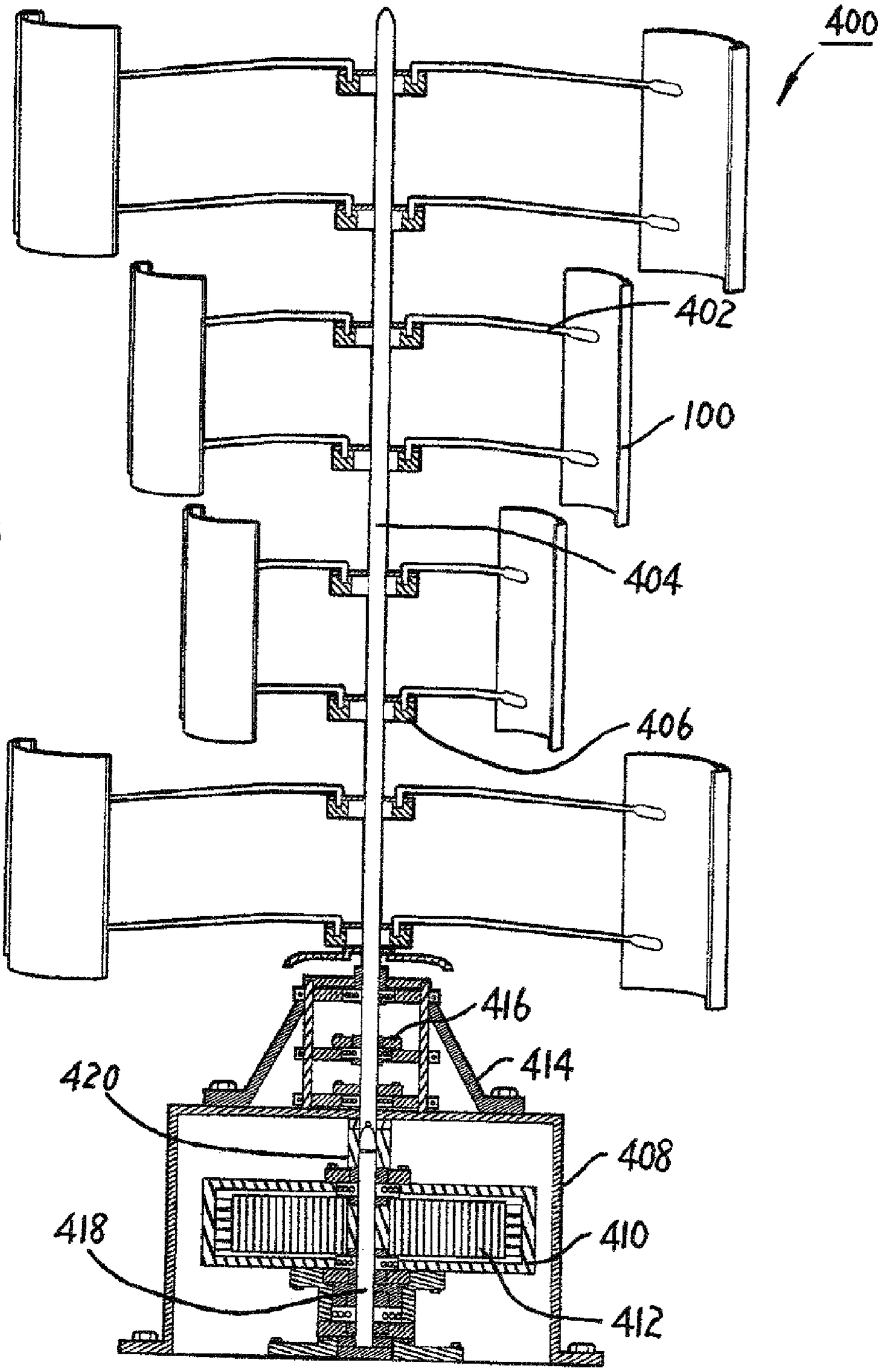


Fig.8

Fig - 9

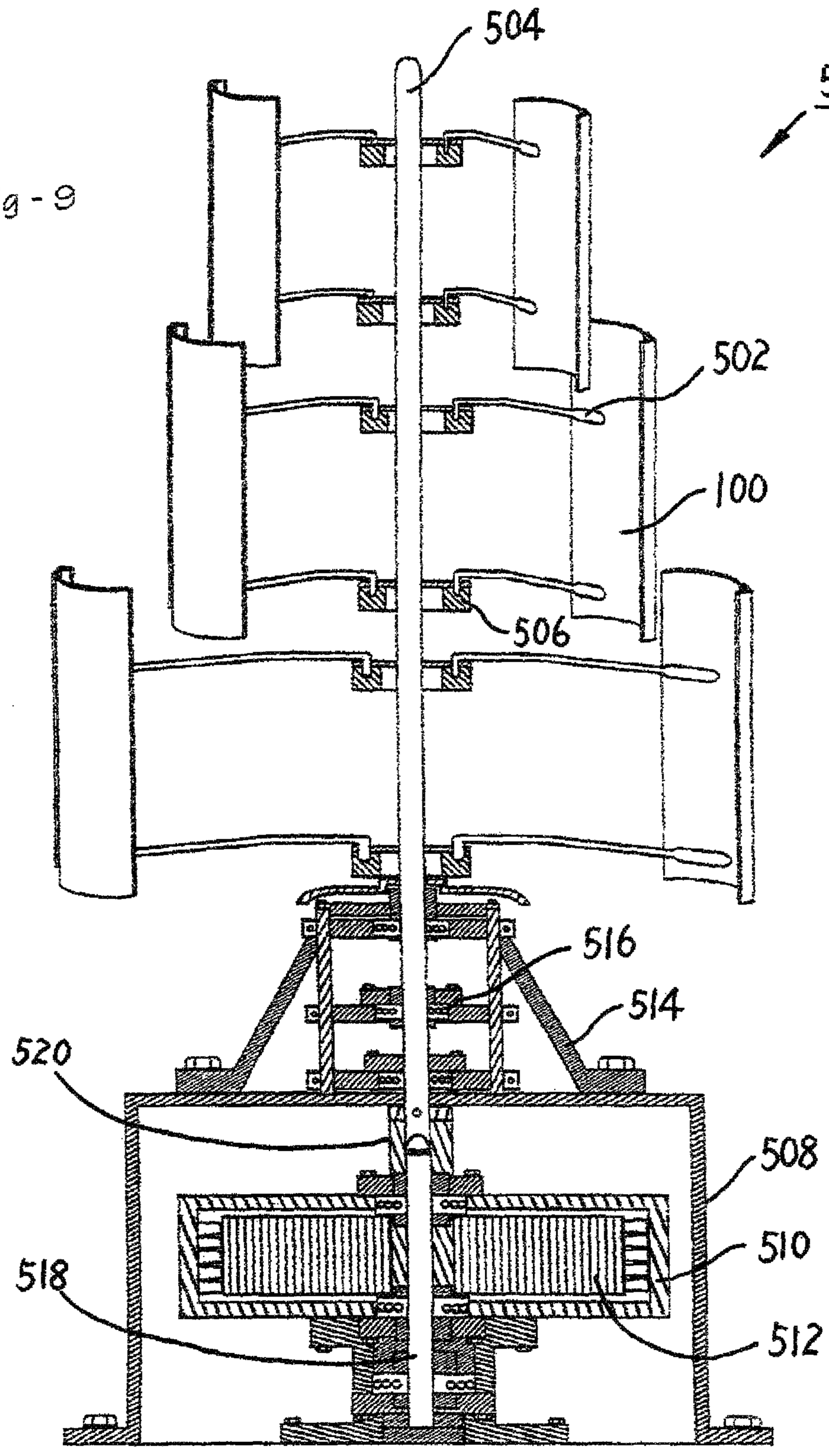
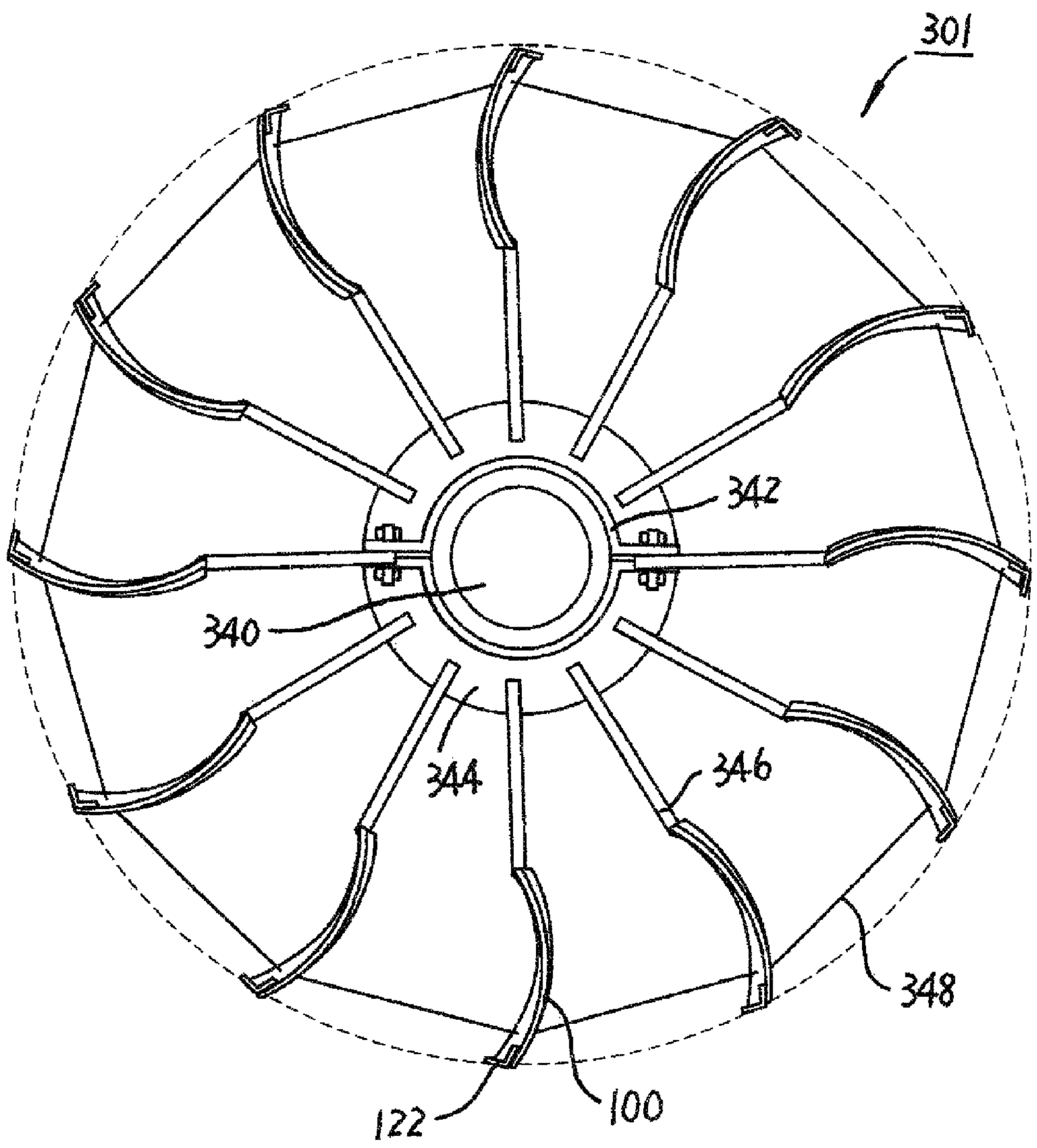


FIG-10



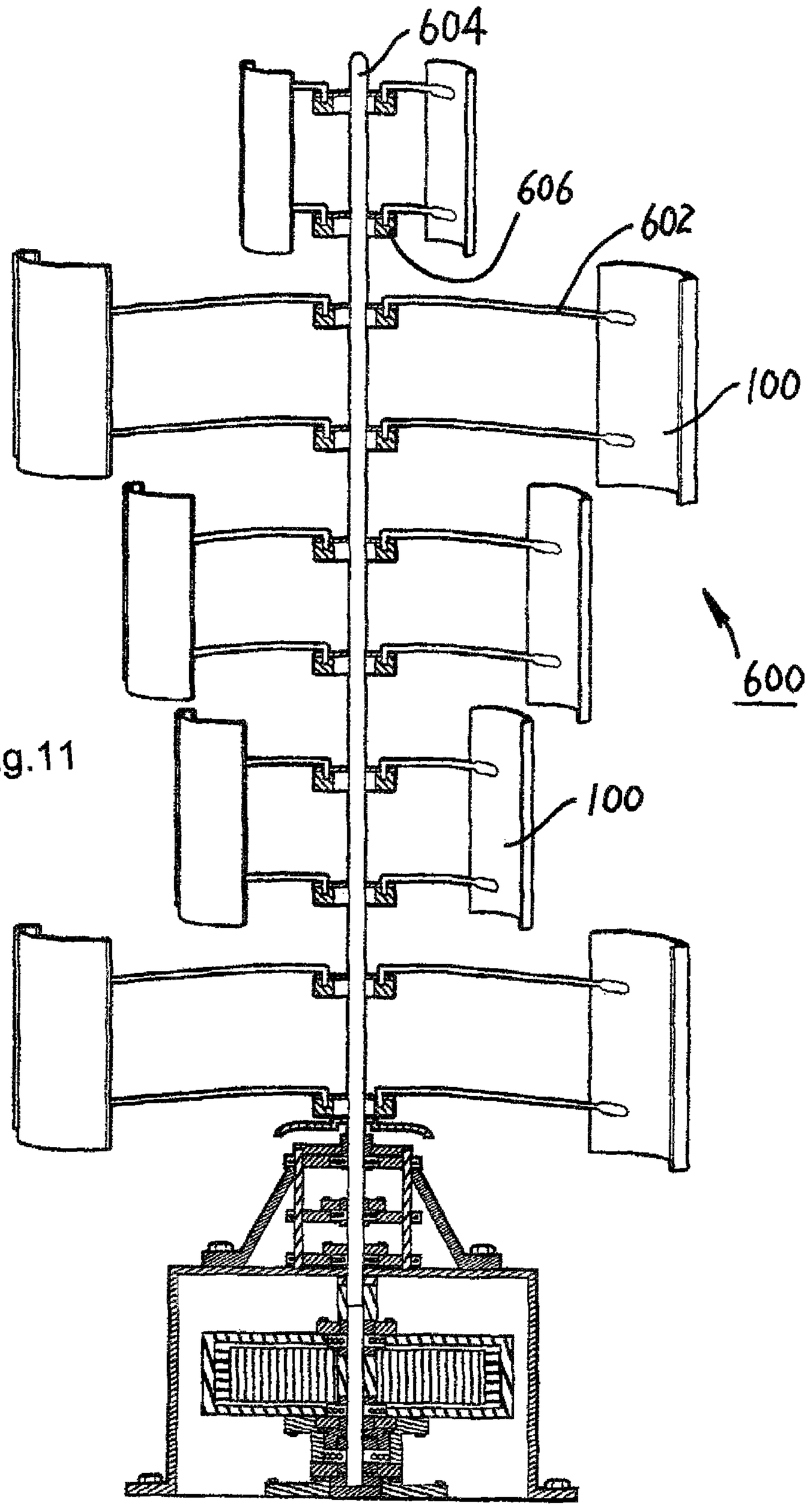


Fig.11

VERTICAL SPIRAL ANGLE WIND TURBINE

This application claims priority from previously filed U.S. provisional application Ser. No. 61/388,088 on Sep. 30, 2010, by Paul Firic under the title VERTICAL SPIRAL ANGLE WIND TURBINE.

FIELD OF THE INVENTION

The present invention relates to wind turbines in particular relates to wind turbine blade technology.

SUMMARY OF THE INVENTION

Historically numerous wind turbines have been designed and deployed using various designs. The major drawback with all of these designs is the complexity used in order to create the wind turbine and the cost involved with manufacturing and deployment of the wind turbines in the field.

Currently many wind turbines require complex mechanical devices in order to ensure that the turbine is oriented in the correct direction. One of the advantages of the current design is that regardless of the direction of the wind the wind turbine will effectively produce power.

BRIEF DESCRIPTION OF THE DRAWINGS

The present device will now be described by way of example only with reference to the following drawings in which;

FIG. **1** is a schematic outer perspective view of a wind turbine blade.

FIG. **2** is a schematic end perspective view of the blade shown in FIG. **1**.

FIG. **3** is a schematic inner perspective view of the blade shown in FIG. **1**.

FIG. **4** is an inner end schematic perspective view of the blade shown in FIG. **1**.

FIG. **5** is an alternate inner perspective view of the blade shown in FIG. **1**.

FIG. **6** is an alternate end inner perspective view of the blade shown in FIG. **1**.

FIG. **7** is a top plan view of a wind rotor, using blade shown in FIG. **1**.

FIG. **8** is a schematic partial cut away perspective view of a wind turbine utilizing the blades depicted in FIG. **1**.

FIG. **9** is an alternate partial cut away perspective view of an alternate wind turbine using blades shown in FIG. **1**.

FIG. **10** is a top plan view of a wind rotor showing blades used in FIG. **1**.

FIG. **11** is an alternate partial cut away perspective view of a wind turbine using blades shown in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present device a vertically oriented blade shown generally as **100** which can be utilized in wind turbines normally constructed of thin planar metal such as steel or aluminum or composite materials such as fiber glass, carbon fiber, or plastic and the like and includes the following major components namely a generally square or rectangular curvilinear shaped blade including an outer surface **102** shown in FIG. **1** an inner surface **120** shown in FIG. **3**, a helical inner edge **106**, an outer edge **108**, a top edge **110** having a radius r shown as **114** and a bottom edge **112**.

The helical inner edge **106** describes a spiral angle theta shown as **118** which is the angle between the helical inner edge **106** and a hypothetical vertical reference line **111** as shown in FIG. **2**. The blade is oriented vertically wherein outer and inner edges **108** and **106** run approximately in the same direction as the vertical reference line **111**.

The inner surface **120** of blade **100** as depicted in FIG. **1** is shown in FIG. **3**. Blade **100** includes an L shaped outer rib **122**, which is positioned along the outer edge **108** of blade **100**.

Outer rib **122** includes a transverse leg portion shown as **126** and a perpendicular leg portion shown as **128**. Blade **100** further includes a blade flange **124**, which runs along bottom edge **112**.

FIGS. **5** & **6** show an alternate blade shown generally as **200** which has the same outer appearance as shown in FIGS. **1** & **2** namely has the same outer surface **102** as depicted in FIGS. **1** & **2**.

Blade **200** includes an inner surface **220** having an outer rib **222** and a central rib **230**. Each of outer ribs **222** and central rib **230** include a transverse leg **226** and a perpendicular leg **228**. Blade **200** also includes a helical inner edge **206**, which is similar to the helical inner edge **106** as depicted in FIGS. **1** & **2**.

Central rib **230** is positioned approximately midway between the inner edge **208** and the helical inner edge **206** of blade **200**.

Blade **200** may be used in instances where the width shown generally as "W" **104** in FIG. **1** becomes so large that additional reinforcing is required in order for blade **200** to keep it's shape in high wind conditions.

FIG. **7** shows schematically a top plan view of a wind rotor **300** showing blades **100** and also blades **200** deployed thereon.

Wind rotor **300** includes a rotor shaft **340**, a collar **342** and shaft flange **344** to which is attached struts **346** which rigidly connect blades **100** and/or blades **200** to rotor shaft **340**.

In addition to maintain the distances between adjacent blades stays **348** are used.

Any number of blades **100** can be used in a wind rotor **300** and another example is shown in FIG. **10** depicting wind rotor **301**. In FIG. **7** for example a wind rotor having a total of 9 blades is depicted whereas in FIG. **10** a wind rotor having a total of 12 blades **100** is depicted.

Any number of blades can be selected depending upon the diameter, size and power required for the wind turbine to produce.

Referring now to FIG. **8**, which is an example of a wind turbine **400**, which shows deployed blades **100** connected to a rotor shaft **400** using struts **402** and collars **406**.

Rotor shaft **404** is coupled to a generator shaft **418** with coupling **420**. Generator **410**, which includes a generator rotor **412**, is housed within housing **408**. Rotor shaft **404** is connected to flange **414** with bearings **416**. Preferably a large diameter generator **410** is selected in order to ensure that maximum power is generated at low rpms. Large diameter generator is defined as having a rotor diameter of at least 50 cm.

FIG. **9** is an alternate example of a wind turbine **500** showing blades **100** rigidly connected to rotor shaft **504** with struts **502** and collars **506**. Similar to wind turbine **400** rotor shaft **504** is connected to generator shaft **518** using couplings **520**. Housing **508** houses a generator **510** having a generator rotor **512**. Rotor shaft **504** is attached to flange **514** using bearings **516**.

FIG. **11** shows yet another alternate embodiment namely a wind turbine **600** using blades **100** deployed thereon. Blades **100** are attached to rotor shaft **604** using strut **602** and collars **606**.

Blade **100** includes a number of unique features as follows.

Firstly there is a helical inner edge **106**, which defines a helix which if projected upwardly would complete a complete circle in about 5 meters in vertical distance. In other words by conceptually extrapolating the helical inner edge **106** upwardly one would create a helix which completes one full rotation over a vertical distance of approximately 3.5 to 6 meters and preferably over a vertical distance of 4 to 5 meters and most preferably over a distance of 5 meters.

Blade **100** also includes a radius shown as r **114** in FIG. **1** and also in FIG. **3** in which the inner surface is a concave surface having an inner radius r **114**, which ranges in between 10 centimeters and 40 centimeters and preferably is in the range 15 to 25 centimeters and most preferably is 20 centimeters.

I claim:

1. A vertically oriented wind turbine blade comprising:

a) a rectangular curvilinear shaped blade which includes a top edge, a bottom edge, an outer edge, a helical inner edge, an inner surface and an outer surface;

b) wherein the top edge is curved and defines a radius R;

c) wherein the helical inner edge defines an angle theta relative to a vertical reference line,

d) wherein the blade further includes an L shaped outer rib with a transverse leg mounted to the inner surface and extending along the outer edge, the outer rib also includes a perpendicular leg extending perpendicular to the transverse leg.

2. The wind turbine blade claimed in claim **1** wherein the blade further includes an L shaped central rib with a transverse leg mounted to the inner surface and extending vertically along substantially the center of the blade, the central rib also includes a perpendicular leg extending perpendicular to the transverse leg and vertically along substantially the center of the blade.

3. The wind turbine blade claimed in claim **2** wherein the blade further includes an L shaped blade flange with one leg of the L mounted to the inner surface and extending along the bottom edge.

4. The wind turbine blade claimed in claim **1** wherein extrapolating the helical inner edge upwardly one would create a helix which completes one full rotation over a vertical distance selected to lie between 3.5 to 6 meters.

5. The wind turbine blade claimed in claim **1** wherein extrapolating the helical inner edge **106** upwardly one would create a helix which completes one full rotation over a vertical distance over a distance of 5 meters.

6. The wind turbine blade claimed in claim **1** wherein the radius R of the top edge is selected to be between 10 centimeters and 40 centimeters.

7. The wind turbine blade claimed in claim **1** wherein the radius R of the top edge is selected to be 20 centimeters.

8. The wind turbine blade claimed in claim **5** wherein the radius R of the top edge is selected to be 20 centimeters.

9. A wind turbine including at least one turbine blade as claimed in claim **1**, mounted to a vertical rotor shaft with at least one transversely oriented strut such that outer edge defines the outer diameter of the turbine and the blade revolves about the rotor shaft.

10. The wind turbine claimed in claim **9**, wherein the rotor shaft is connected to a large diameter generator.

* * * * *